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PATENT APPLICATION

ATTORNEY DOCKET NO. 100110288-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): PEH, Li-Shiuan et al.

Confirmation No.: 3926

Application No.: 10/066,051

Examiner: PATEL, Shambhavi K.

Filing Date: January 31, 2002

Group Art Unit: 2128

Title: GENERATING INTERCONNECT FABRIC REQUIREMENTS

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on July 24, 2006.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $120 ☐ 2nd Month $450 ☐ 3rd Month $1020 ☐ 4th Month $1590

☒ The extension fee has already been filed in this application.

☐ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of 500.00. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees.

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Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: PEH, Li-Shiuan	Examiner: PATEL, Shambhavi K.
Serial No. 10/066,051	Art Unit: 2128
Filed: January 31, 2002	Confirmation No. 3926
Entitled: GENERATING INTERCONNECT FABRIC REQUIREMENTS	**APPEAL BRIEF**

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madame:

This is Applicants' brief on appeal from the final rejection of claims 1-13 and 15-28.

(i) Real Party in Interest

The real party in interest is Hewlett-Packard Development Company, L.P., the assignee of record, which is a wholly-owned affiliate of Hewlett-Packard Company.

(ii) Related Appeals and Interferences

The appellant is not aware of any appeals or interferences related to the above-identified patent application.

(iii) Status of Claims

Claims 1-13 and 15-28 are pending in this application. Claims 1-13 and 15-28 have been finally rejected and are the subject of this appeal. Claim 14 has been canceled.

(iv) Status of Amendments

An after-final amendment was filed on October 4, 2006, requesting changes to the dependencies of certain claims. As of today's date, October 24, 2006, according to the U.S. Patent and Trademark Office's publicly accessible Patent Application Information Retrieval (PAIR) system, the amendments have not been entered. In telephone calls, Examiner Patel indicated that the amendment had not yet been docketed to her though she indicated that she would consider entering the amendments assuming they do not raise new issues. The Applicants believe that the amendments do not raise new issues and that the amendments place the claims in better form for consideration on appeal. Therefore, this appeal brief assumes that the amendments will be entered.

(v) Summary of Claimed Subject Matter

Background

Interconnect fabrics provide for communication among nodes in a network. For example, a storage area network may be arranged as a set of computers as source nodes which are connected to a set of storage devices as terminal nodes via an interconnect fabric that includes communication links and interconnect devices, such as hubs, routers, switches, etc. Applicants' specification at page 1, lines 8-17.

The communication requirements for an interconnect fabric may be characterized in terms of a set of flow requirements which specify required communication bandwidth between nodes. The design of an interconnect fabric involves selecting the appropriate arrangement of communication links and interconnect devices that will meet the flow requirements. Applicants' specification at page 1, lines 20-26.

Claim 1

Applicants' claim 1 is directed toward "[a] computer implemented method for generating an interconnect fabric design problem specification, the problem specification including requirements for a plurality of flows among a set of network nodes and the problem specification being suitable for application of a design technique by which physical communication links and devices are arranged to meet the flow requirements." Figure 1 of the Applicants' specification shows a flow diagram of the method; an overview of the method is provided at page 4, lines 6-13; and the method is described in more detail at page 4, line 14, to page 9, line 14.

Therefore, claim 1 is directed toward a process by which a fabric design problem specification is generated. It is important to distinguish between the

Applicants' invention, which is directed toward generation of a design problem specification, and techniques for finding solutions to such design problems. Instead of generating a problem specification, techniques for finding solutions to design problems assume that the design problem has been defined and use the problem specification as a starting point for finding a solution. The ability to generate a wide variety of problem specifications is, however, useful for evaluating the effectiveness of design solution techniques. See Applicants' specification at page 1, line 27 to page 2, line 1.

Steps of the method of claim 1 include "selecting, from among the set of network nodes, a source node and a terminal node for a flow to be added to the requirements." This aspect of the method is explained in detail in the Applicants' specification at page 4, line 27 to page 5, line 9.

Claim 1 further specifies performing steps of "determining a maximum capacity available at the selected source node and the selected terminal node" and "generating the flow having a capacity less than or equal to the lower of the maximum capacity of the source node and the terminal node." As explained in the Applicants' specification at page 5, lines 10-27, it is preferred that the flow requirements to do not exceed the maximum capacities of the source or terminal nodes; otherwise, it becomes infeasible for an interconnect fabric to be designed that will meet the flow requirements. The Applicants' specification at page 5, line 28 to page 7, line 8, explains in more detail how these steps are performed and provides a specific example with reference to Figures 2 and 3.

Claim 1 further specifies that the step of selecting a source node and a terminal node, the step of determining a maximum capacity of those nodes, and the step of generating a flow, are repeated, "thereby adding requirements for flows to the

problem specification such that at least one of the source or terminal nodes is assigned more flows than there are ports available at the node." The Applicants' specification at page 7, line 9, to page 9, line 30, explains that flow requirements are repeatedly added to the problem specification and provides a specific example with reference to Figures 4 and 5. Specifically, Figure 5 shows that source node 12 is assigned five flows (flows 62, 64, 76, 66 and 68), but has only two available ports (ports 38 and 40). Also, terminal node 24 shown in Figure 5 is assigned six flows (flows 60, 66, 70, 72, 74 and 76), but has only three available ports (ports 32, 34 and 36). Thus, the additions are cumulative and nodes and 12 and 24 are each assigned more flows than there are ports available at the node. Assigning more flows to a node than there are ports available at the node means that solving the problem will require something more than simply assigning each flow to a different physical link. This can be seen from Figure 7 of the Applicants' specification which shows an exemplary solution to the design problem. This solution uses interconnect devices 82, 84 and 86 and several physical links to carry the flow requirements specified by the problem. See Applicants' specification at page 9, lines 16-18 and Figure 7.

Claim 13

Claim 13 is an independent claim which is directed toward "[a] system for generating an interconnect fabric design problem specification for communication among a set of nodes." Figure 10 of the Applicants' specification shows the system in block diagram form. Page 14, line 16 to page 16, line 6 of the Applicants' specification describe the system in more detail. Specifically, at page 14, lines 16-18, the Applicants' specification states that the system includes a fabric design problem generation tool 300 that may employ the methods described within the specification

(and described above with reference to method claim 1) to generate a fabric design problem specification. The fabric design generation tool may be implemented in computer software and/or hardware to perform its functions. Applicants' specification at page 14, lines 18-20.

Claim 13 further states that the system comprises: "a set of design information including user-specified parameters for the design problem specification." The Applicants' specification at page 14, lines 20-24, explains that the design information may include a list of source nodes and terminal nodes, a set of user-specified parameters, and a set of device properties, and may be implemented as an information store such as a file or set of files, or a database.

Claim 13 further states that the fabric design problem generation tool "generates the design problem specification for the interconnect fabric by adding flows to a set of flow requirements among the set of nodes in response to the design information such that at least one of the nodes is assigned more flows than there are ports available at the node and wherein said fabric design problem generation tool selects, from among the set of network nodes, a source node and a terminal node for a flow to be added to the flow requirements, determines a maximum capacity available at the selected source node and the selected terminal node, and generates the flow having a capacity less than or equal to the lower of the maximum capacity of the source node and the terminal node." Therefore, the functions performed by the fabric design problem generation tool are analogous to the steps recited by claim 1, described above.

Claims 2 and 15

Claim 2 is dependent from claim 1 and recites that "said determining a maximum capacity comprises determining capacity available at each port of the source node and selecting the highest available capacity for the source node ports and determining capacity available at each port of the terminal node and selecting the highest available capacity for the terminal node ports." Claim 15 is dependent from claim 13 and recites functional limitations for the fabric design problem generation tool that are similar to the limitations of claim 2.

The Applicants' specification at page 5, line 28 to page 6, line 10 explain that the maximum capacity available at each of the selected source node and the selected terminal node is determined from the available capacity among all of the ports of the source node and among all of the ports of the terminal node. This avoids adding a flow to the requirements than may exceed the maximum capacity of either the source node or the terminal node. Applicants' specification at page 6, lines 11-18.

Claims 3 and 16

Claim 3 is dependent from claim 2 and recites that "said determining a capacity at a port of the source or terminal node depends on a specified degree of port saturation and unused port capacity." Claim 16 is dependent from claim 15 and recites functional limitations for the fabric design problem generation tool that are similar to the limitations of claim 3.

The Applicants' specification explains that the user specified parameters may also specify a desired level of port saturation. For example, determining capacity available at a node may depend on port saturation at the node and on unused capacity at each port of the node. Also, a user may specify a percentage of port capacities that

may be used. In examples discussed in the specification, the maximum bandwidth capacity of a port was assumed to be 100 Mb/s. This capacity was then used to determine that maximum bandwidth of a flow that was feasible to add to the flow requirements. In an example, the percentage of port capacity that may be used may be assumed to be one hundred percent (100%). Applicants' specification at page 15, lines 9-22.

Claims 4 and 17

Claim 4 is dependent from claim 1 and recites that "said selecting, said determining and said generating is repeated until a stop condition is reached." Claim 17 is dependent from claim 13 and recites functional limitations for the fabric design problem generation tool that are similar to the limitations of claim 4.

The Applicants' specification explains at page 9, lines 1-2, that the method may be repeated, adding flows to the interconnect fabric design problem until a stop condition is reached. Examples of stop conditions are given at page 9, lines 2-10. And, as explained at page 9, lines 11-14, once the stop condition is reached, the design problem includes a set of flow requirements that corresponds to the set of nodes. Figure 6 shows an exemplary design problem that includes a set of flow requirements 80 among the source nodes 10-16 and the terminal nodes 22-30.

Claims 5 and 18

Claim 5 is dependent from claim 4 and recites that "the stop condition is reached when each node in the set has at least a specified number of flows." Claim 18 is dependent from claim 17 and also recites this limitation.

The particular stop condition of claims 5 and 18 is discussed at page 9, lines 2-4 of the Applicants' specification.

Claims 6 and 20

Claim 6 is dependent from claim 1 and recites that "said set of network nodes comprises a cluster of nodes and wherein the design problem includes a plurality of clusters." Claim 20 is dependent from claim 13 and also recites this limitation.

The Applicants' specification explains at page 9, line 29 to page 10, line 1, that an interconnect fabric design problem may be formed having clusters of nodes and that a cluster of nodes is a set of nodes which primarily or solely communicate with each other. Clusters are shown in Figure 9 of the Applicants' disclosure. Pairs of a source node and a terminal node may be selected according to a sequence in which a first source node of the cluster is selected and, then, flows, if any, are formed between the selected source node and the terminal nodes of the cluster in the manner described above with reference to claim 1. Applicants' specification at page 11, lines 5-22.

Claims 7 and 21

Claim 7 is dependent from claim 6 and recites that "the design problem includes at least one flow between a pair of the clusters." Claim 21 is dependent from claim 20 and also recites this limitation.

The Applicants' specification at page 13, line 2, explains that flows may be added between clusters.

Claims 8 and 22

Claim 8 is dependent from claim 7 and recites that "the design problem further comprises at least one node not in the clusters having a flow to a node in the clusters." Claim 22 is dependent from claim 21 also recites this limitation.

The Applicants' specification at page 10, lines 1-3, explains that an interconnect fabric design problem may be formed having globally connected nodes and that a globally-connected node is one that communicates with nodes of more than one cluster. As shown in Figure 9 and explained at page 10, lines 17-31, globally-connected nodes 270 and 272, which are not in the clusters 250 and 252, may have flow requirements 268, 274, 276, 278, to nodes in the clusters.

Claims 9 and 23

Claim 9 is dependent from claim 1 and recites "generating an additional flow and determining whether to add the flow to the design problem according to a specified probability." Claim 23 is dependent from claim 13 and recites functional limitations for the fabric design problem generation tool that are similar to the limitations of claim 9.

The Applicants' specification at page 14, lines 4-8, explains that in one embodiment, after requirements for a flow are generated by the method 100 of Figure 1, the flow may be discarded according to the probability. For example, assume that the maximum number of flows that may be added is three and the specified probability is seventy percent (70%). In which case, the method 100 is performed three times. For each flow formed by the method 100, the specified probability of seventy percent is applied to the flow determine whether to keep or discard the flow

(e.g., the probability of keeping any one of the flows is 70%). Applicants' specification at page 14, lines 8-14.

Claims 10 and 24

Claim 10 is dependent from claim 9, and recites "repeating said steps of generating an additional flow and determining whether to add the flow to the design problem a number of times determined from a difference between a current number of flows and a specified maximum number of flows." Claim 24 is dependent from claim 23 and recites functional limitations for the fabric design problem generation tool that are similar to the limitations of claim 10.

The Applicants' specification at page 13, lines 26-27, explains that a maximum number of flows per source node (or per terminal node) in a cluster may be specified. This number may then be multiplied by the number of source nodes (or terminal nodes) in the cluster to determine the maximum number of flows for a cluster. Applicants' specification at page 13, lines 27-30. Then, the number of existing flows in the cluster may be subtracted from the product to determine the maximum number that may be added. Applicants' specification at page 13, line 30 to page 14, line 2.

Claim 11

Claim 11 is dependent from claim 1 and recites that "the flow is assigned to a single port at each of the source node and the terminal node."

The Applicants' specification at page 5, lines 10-15, explains that in an embodiment, the flow requirements for the design problem do not exceed the capacities of the source and terminal nodes or their ports. This is because it becomes

infeasible for an interconnect fabric to be designed that will meet such flow requirements without also modifying the source and terminal nodes or allowing flows to be split across multiple ports. Applicants' specification at page 5, lines 15-19. However, for some network design problems, splitting of flows across multiple ports may be desired, particularly to test design techniques that can accommodate such flows. Applicants' specification at page 5, lines 19-21. When splitting is not allowed, the flow is assigned to a single port at each of the source node and the terminal node.

Claim 12

Claim 12 is dependent from claim 1 and recites that "the flow is split among multiple ports at one or both of the source node and the terminal node."

The Applicants' specification at page 5, lines 19-21, explains that for some network design problems, splitting of flows across multiple ports may be desired, particularly to test design techniques that can accommodate such flows.

Claim 19

Claim 19 is dependent from claim 16 and recites that "the stop condition is based on bandwidth levels of the flow requirements."

The Applicants' specification at page 9, lines 4-7, explains that the stopping condition may include a random aspect, such as reaching a minimum number of flows or level of bandwidth required for the nodes and then adding a random number of additional flows or bandwidth levels to the design problem. The Applicants' specification at page 9, lines 7-10, explains that the stopping condition may be based on ratio of a sum of bandwidth requirements assigned to a node to a sum of bandwidth capacity at the node.

Claims 25 and 27

Claim 25 is dependent from claim 1 and recites that "the capacity for a generated flow is randomly selected to be a value less than or equal to the lower of the maximum capacity of the source node and the terminal node." Claim 27 is dependent from claim 13 and also recites this limitation.

This feature is described in the Applicants' specification at least at page 6, lines 11-13 and 19-23.

Claims 26 and 28

Claim 26 is dependent from claim 1 and recites that "the flow is split among multiple ports at one or both of the source node and the terminal node." Claim 28 is dependent from claim 13 and also recites this limitation.

The Applicants' specification at page 7, line 25, to page 8, line 13, gives several examples showing how the available capacity is reduced by the capacity of assigned flows.

(vi) Grounds of Rejection to be Reviewed on Appeal

Claims 1-13 and 15-24, 26 and 28 are rejected under 35 U.S.C. § 103 as being obvious over U.S. Patent No. 6,209,033 to Datta et al. (hereinafter, "Datta") in view of Shahoumian et al., "Storage Area Network Fabric Design," (hereinafter "Shahoumian").

Claims 25 and 27 are rejected under 35 U.S.C. § 103 as being obvious over Datta, in view of Shahoumian and further in view of Kamath et al., "Routing and

Admission Control in General Topology Networks with Poisson Arrivals" (hereinafter, "Kamath").

(vii) Argument

Claims 1 and 13

Claims 1-13 and 15-24, 26 and 28 are rejected under 35 U.S.C. § 103 as being obvious over U.S. Patent No. 6,209,033 to Datta et al. (hereinafter, "Datta") in view of Shahoumian et al., "Storage Area Network Fabric Design," (hereinafter "Shahoumian"). Particularly, regarding claim 1, the final rejection mailed on March 30, 2006, alleges that Datta (at col. 2, lines 25-29; col. 3, lines 1-10 and 24-35; col. 6, lines 33-61; col. 12, lines 47-53; and Figure 2, steps 63 and 64) teaches all of the claim limitations except that Datta fails to disclose "a problem specification that requires adding more flows than there are ports to node." However, the final rejection states that Shahoumian teaches this limitation at page 3, slides 5 and 6, that it would have been obvious to one of ordinary skill in the art to combine the teachings of Datta and Shahoumian "in order to develop a design method that is not tedious, time-consuming, or error prone (Shahoumian: page 1, slide 6)."

As explained above in the "Summary of Claimed Subject Mattter," Applicants' claim 1 directed toward "[a] computer implemented method for generating an interconnect fabric design problem specification, the problem specification including requirements for a plurality of flows among a set of network nodes and the problem specification being suitable for application of a design technique by which physical communication links and devices are arranged to meet the flow requirements." Therefore, claim 1 is directed toward a process by which a

fabric design specification is generated. This is to be contrasted with finding a solution to the problem specification.

Datta is directed toward an apparatus for network capacity evaluation and planning. Title of Datta. The network capacity evaluation and planning (CEP) is performed based upon the traffic across the links of the network. Datta at col. 2, lines 54-56. Once a link's traffic volume has been measured, it is compared with the link's traffic capability, and the resulting parameters may be compared with the traffic and capability of other links of the network to create measures of network capacity and balance. Datta at col. 2, lines 56-60 and col. 6, lines 51-55. Then, simulated changes to the network configuration may be made by substituting simulated traffic volume amounts and capabilities for selected link traffic measurements and capabilities, and the resulting determinations of network capacity and balance may then be compared to determine whether the simulated changes represent a preferred network configuration. Datta at col. 2, lines 61-67.

Therefore, the difference is that Datta does not teach or suggest a method for generating an interconnect design problem, the problem including requirements for a plurality of flows among a set of network nodes, nor particular steps for adding a flow to the requirements. However, these features are recited in Applicants' claim 1. Therefore, these features of claim 1 which are alleged to be taught by Datta in the final rejection are, in fact, not taught by Datta. Rather, Datta discloses making simulated changes to an actual network in use. These simulated changes are to simulate a different amount of traffic across a link or to simulate a different traffic capability of a link. See Datta at col. 2, lines 54-67.

Shahoumian shows a slide presentation on "Storage Area Fabric Design." See slide 1 of Shahoumian. The authors of Shahoumian include John Wilkes and Julie

Ward, two of the inventors of the present application. This slide presentation gives an overview of various techniques for solving interconnect design problems, given a "SAN Fabric Design Problem" as a starting point. See slide 3 of Shahoumian. Therefore, in contrast to claim 1, Shahoumian does not teach or suggest a method for generating an interconnect design problem, but instead, assumes that the problem is simply provided as a starting point to which the various techniques for solving such a problem may be applied. See slides 1-6 of Shahoumian. Therefore, the features of claim 1, which are not taught by Datta are also not taught by Shahoumian.

For at least this reason, claim 1 is allowable over Datta and Shahoumian. Claims 2-12 are allowable at least because they depend from claim 1.

In addition, the specific limitations of claim 1 include "selecting, from among the set of network nodes, a source node and a terminal node for a flow to be added to the requirements, determining a maximum capacity available at the selected source node and the selected terminal node, generating the flow having a capacity less than or equal to the lower of the maximum capacity of the source node and the terminal node." The final rejection relies upon: col. 2, lines 25-29, of Datta as disclosing certain of these elements of claim 1; col. 3, lines 1-10, and 24-35, of Datta as disclosing other of these elements of claim 1; and col. 6, lines 33-61, of Datta as disclosing still other of these elements of claim 1. However, at col. 2, lines 25-29, Datta is clearly discussing "prior art" which is shown in Figure 1 of Datta. Particularly, Datta is discusses prior network traffic monitors which were placed at selected points in a network to monitor network activity. See Datta at col. 2, lines 19-29. Datta describes this prior art as having drawbacks because they provide only an ability to monitor, but do not provide an ability to evaluate alternative network topologies or to perform comparison studies. See col. 2, lines 41-52 of Datta. In

contrast, at col. 3, lines 1-10 and 24-35, Datta discusses the "invention." Particularly, this portion of Datta is within the "Summary of the Invention" of Datta and discusses that an embodiment of the invention is directed toward a method for evaluating network traffic, that communications capability may be evaluated by evaluating link balance and that upper and lower bounds of link utilization may be defined. Then, at col. 6, lines 33-45, Datta is again discussing prior art and its perceived disadvantages. In particular, col. 6, lines 36-37, of Datta refer to the "main disadvantages" of certain prior capacity evaluation and network planning (CEP) products. And, at col. 6, lines 46-61, Datta reverts to discussing "an embodiment of the invention" which is said to "overcome such limitations." Therefore, the final rejection does not set forth a *prima facie* case for obviousness at least because it does not set forth elements of claim 1 which are alleged to be taught by Datta as they are arranged in the claim. Instead, the Office Action relies both upon passages of Datta that discuss the "prior art" with respect to Datta and upon other passages of Datta that discuss "the invention" of Datta.

Shahoumian does not cure these deficiencies of Datta. Therefore, this is another reason why claim 1 and dependent claims 2-12 are allowable over Datta and Shahoumian.

Moreover, the final rejection relies upon col. 2, lines 25-29, of Datta as disclosing "selecting, from among the set of network nodes, a source node and a terminal node for a flow to be added to the requirements." As explained above, this portion of Data merely discusses prior network traffic monitors which were placed at selected points in a network to monitor network activity. This portion of Datta teaches nothing about adding to requirements for an interconnect design problem

specification, nor does it teach selecting a source and terminal node for adding to such requirements.

Further, the final rejection relies upon col. 3, lines 1-10, and 24-35, of Datta as disclosing "determining a maximum capacity available at the selected source node and the selected terminal node." As explained above, this portion of Data merely discusses that an embodiment of the invention is directed toward a method for evaluating network traffic, that communications capability may be evaluated by evaluating link balance and that upper and lower bounds of link utilization may be defined. This portion of Datta does not disclose determining a maximum capacity available at a source node and a terminal node which are selected for adding to requirements for an interconnect design problem specification.

In addition, the final relies upon col. 6, lines 33-61, of Datta as disclosing "generating the flow having a capacity less than or equal to the lower of the maximum capacity of the source node and the terminal node." As explained above, this portion of Data merely discusses that once a link's traffic volume has been measured, it is compared with the link's traffic capability, and the resulting parameters may be compared with the traffic and capability of other links of the network to create measures of network capacity and balance. Datta at col. 2, lines 56-60 and col. 6, lines 51-55. Then, simulated changes to the network configuration may be made by substituting simulated traffic volume amounts and capabilities for selected link traffic measurements and capabilities, and the resulting determinations of network capacity and balance may then be compared to determine whether the simulated changes represent a preferred network configuration. Datta at col. 2, lines 61-67. Therefore, this portion of Datta does not disclose generating a flow which is added to requirements for an interconnect design problem specification.

Shahoumian also does not cure these deficiencies of Datta. This is because Shahoumain assumes that the fabric design problem is simply provided as a starting point to which the various techniques for solving such a problem may be applied. These are additional reasons why claim 1 and dependent claims 2-12 are allowable over Datta and Shahoumian.

Further, the final rejection alleges that the limitation of claim 1 which requires "repeating said selecting, said determining and said generating thereby adding requirements for flows to the problem specification such that at least one of the source or terminal nodes is assigned more flows than there are ports available at the node" is taught, in part, by Datta and, in part, by Shahoumian. Particularly, the final rejection states that Datta teaches repeating the steps of claim 1 "until all configurations are tested (figure 6: steps 63 and 64 are repeated)." However, the different scenarios defined and evaluated steps 63 and 64 of Datta define alternative configurations for the in-use network of Datta, rather than additional requirements for the network. See Datta at col. 7, lines 21-27. It should also be noted that because there is no cumulative effect given to the different scenarios of Datta, Datta does not teach or suggest that anything is added to a problem specification each time a different scenario is tested.

Shahoumian also does not cure these deficiencies of Datta. Therefore, these are additional reasons why claim 1 and dependent claims 2-12 are allowable over Datta and Shahoumian.

The final rejection states that it would have been obvious to one of ordinary skill in the art to combine the teachings of Datta and Shahoumian "in order to develop a design method that is not tedious, time-consuming, or error prone (Shahoumian: page 1, slide 6)." However, Shahoumian is characterizing "current design methods"

in slide 6 as being "tedious," "time consuming," and "error prone." As mentioned above, the design methods discussed by Shahoumian are various techniques for solving interconnect design problems, given a design problem as a starting point. Therefore, they are unrelated to the object of claim 1 which is directed toward generating a design problem specification. Accordingly, this alleged motivation would not have motivated a person to combine Shahoumian with Datta to achieve Applicants' claim 1. This is another reason why claim 1 and dependent claims 2-12 are allowable over Datta and Shahoumian.

As explained above in the "Summary of Claimed Subject Matter," claim 13 is directed toward "[a] system for generating an interconnect fabric design problem specification" comprising "a fabric design problem generation tool that generates the design problem specification for the interconnect fabric." Therefore, similarly to Applicants' claim 1, claim 13 is directed toward generation of a fabric design specification. This is to be contrasted with finding a solution to the problem specification.

As explained above, Datta is directed toward an apparatus for network capacity evaluation and planning. Title of Datta. Therefore, the difference is that Datta does not teach or suggest a system for generating an interconnect design problem specification. However, these features are recited in Applicants' claim 13. Therefore, these features of claim 13 which are alleged to be taught by Datta in the final rejection are, in fact, not taught by Datta. Shahoumian also does not teach or suggest a system for generating an interconnect design problem, but instead, assumes that the problem is simply provided as a starting point to which the various techniques for solving such a problem may be applied. See slides 1-6 of Shahoumian.

Therefore, the features of claim 13, which are not taught by Datta are also not taught by Shahoumian.

For this reason, and for at least the reasons explained above with respect to claim 1, claim 13 is allowable over Shahoumian. Claims 15-28 are allowable at least because they depend from claim 13.

Claims 2 and 15

Claims 2 and 15 require determining a maximum capacity by determining capacity available at each port of the source node and selecting the highest available capacity for the source node ports and determining capacity available at each port of the terminal node and selecting the highest available capacity for the terminal node ports.

The final rejection states that Datta does not disclose examining each port individually to determine maximum capacity, but that it would have been obvious to do so. The Applicants disagree. Datta teaches making simulated changes to an in-use network including simulating a different amount of traffic across a link or simulating a different traffic capability of a link. Therefore, Datta assumes that the capacity of a link can be changed. See Datta at col. 2, lines 54-67. As such, there is no need for Datta to determine maximum capacity by examining each port of a node. Accordingly, there would be no motivation to modify Datta in the manner suggested in the final rejection.

This is another reason why claims 2 and 15 are allowable.

Claims 3 and 16

Claims 3 and 16 require that determining a capacity at a port of the source or terminal node depends on a specified degree of port saturation and unused port capacity. The final rejection states that Datta and Shahoumian teach the limitations of a specified degree of port saturation and unused port capacity for determining maximum capacity, but does not appear to specify where they are allegedly taught. The Applicants submit that Datta and Shahoumain do not teach these additional limitations of claims 3 and 16.

This is another reason why claims 3 and 16 are allowable.

Claims 4 and 17

Claims 4 and 17 require that the steps of selecting, determining and generating which are recited in claims 1 and 13 are repeated until a stop condition is reached. The final rejection alleges that Datta teaches this limitation since Datta "tests all links present in the network." The Applicants disagree. As explained above, Datta and Shahoumain do not teach the process of claim 1 or 13. Accordingly, they also do not teach performing them until a stop condition is reached.

This is another reason why claims 4 and 17 are allowable.

Claims 5 and 18

Claims 5 and 18 require that the stop condition is reached when each node in the set has at least a specified number of flows. The final rejection states that Datta teaches this limitation at col. 6, lines 55-61, by teaching that the links "are assigned flows according to the specified substitutions to be made." The Applicants disagree with this reasoning. Taken together with the claims from which they depend, it is

clear that claims 5 and 18 require adding to flow requirements which are cumulated until each node has at least a specified number of flows assigned to it. Datta does not teach any such cumulating of flows assigned to nodes. As such, Datta cannot teach the particular stop condition for doing so that is specified in claims 5 and 18.

This is another reason why claims 5 and 18 are allowable.

Claims 6 and 20

Claims 6 and 20 require that the set of network nodes comprises a cluster of nodes and wherein the design problem includes a plurality of clusters. The final rejection states that Datta teaches this limitation at col. 2, lines 12-16. This portion of the background section of Datta merely states that "[g]enerally, a network is made up of one or more physical or logical subnets (segments), which each subnet includes a plurality of nodes (e.g., servers and host computers)." However, this portion of Datta is referring to a "network" as having such features, whereas, Applicants' claims 6 and 10 recite "the design problem" (i.e. the fabric design problem specification) as having the features set out in claims 6 and 20. The fabric design problem specification of claims 6 and 20 is not a "network," but is instead a set of requirements for a network which are a starting point for finding a design solution.

This is another reason why claims 6 and 20 are allowable.

Claims 7 and 21

Claims 7 and 21 require that the design problem includes at least one flow between a pair of the clusters. The final rejection states that Datta teaches this limitation at col. 2, lines 12-16 and Figure 8. As explained above in connection with claims 6 and 20, this portion of Datta is referring to a "network" as having such

features, whereas, Applicants' claims 7 and 21 recite "the design problem" (i.e. the fabric design problem specification) as having the features set out in claims 7 and 21. The fabric design problem specification of claims 7 and 21 is not a "network," but is instead a set of requirements for a network which are a starting point for finding a design solution.

This is another reason why claims 7 and 21 are allowable.

Claims 8 and 22

Claims 8 and 22 require that the design problem further comprises at least one node not in the clusters having a flow to a node in the clusters. The final rejection states that Datta teaches this limitation at col. 2, lines 12-16 and Figure 8. As explained above in connection with claims 6, 7, 20 and 21, this portion of Datta is referring to a "network" as having such features, whereas, Applicants' claims 8 and 22 recite "the design problem" (i.e. the fabric design problem specification) as having the features set out in claims 8 and 22. The fabric design problem specification of claims 8 and 22 is not a "network," but is instead a set of requirements for a network which are a starting point for finding a design solution.

This is another reason why claims 8 and 22 are allowable.

Claims 9 and 23

Claims 9 and 23 require generating an additional flow and determining whether to add the flow to the design problem according to a specified probability. The final rejection states that Datta teaches this limitation at col. 6, lines 33-61, and uses the term "probability" in reference to Datta. This portion of Datta teaches essentially that simulated changes to the network configuration may be made by

substituting simulated traffic volume amounts and capabilities for selected link traffic measurements and capabilities, and the resulting determinations of network capacity and balance may then be compared to determine whether the simulated changes represent a preferred network configuration. The Applicants have studied this portion of Datta and are unable to find any reference to a "probability" or anything that is conceptually similar. As such, Datta cannot teach determining whether to add a flow to the design problem according to a specified probability, as is recited in Applicants' claims 9 and 23.

This is another reason why claims 9 and 23 are allowable.

Claims 10 and 24

Claims 10 and 24 require repeating the steps of generating an additional flow and determining whether to add the flow to the design problem a number of times determined from a difference between a current number of flows and a specified maximum number of flows. The final rejection references Datta at col. 6, lines 33-61, for this claim limitation (as well as that of claim 9 above). However, the Applicants are unable to find such a teaching in Datta. Rather, claims 10 and 24 require adding to flow requirements a number of times determined from a difference between a current number of flows and a specified maximum number of flows. Taken together with the claims from which claims 10 and 24 depend, it is clear these flow requirements are cumulated. Datta does not teach any such cumulating of flow requirements assigned to nodes. As such, Datta cannot teach the particular conditions specified in claims 10 and 24 for adding a flow to the cumulated requirements.

This is another reason why claims 10 and 24 are allowable.

Claim 11

Claim 11 stands or falls with claim 1 from which it depends.

Claim 12

Claim 11 stands or falls with claim 1 from which it depends.

Claim 19

Claim 19 requires that the stop condition is based on bandwidth levels of the flow requirements. The final rejection states that Datta teaches this limitation at col. 13, lines 14-26. The Applicants disagree. Taken together with the claims from which claim 19 depends, it is clear that claim 19 requires adding to flow requirements which are cumulated and stopping this adding based on bandwidth levels of the flow requirements. Datta does not teach any such cumulating of flows assigned to nodes. As such, Datta cannot teach the particular stop condition for doing so that is specified in claim 19.

Claims 25 and 27

Claims 25 and 27 are rejected under 35 U.S.C. § 103 as being obvious over Datta, in view of Shahoumian and further in view of Kamath et al., "Routing and Admission Control in General Topology Networks with Poisson Arrivals" (hereinafter, "Kamath"). Particularly, the final rejection states that Datta and Shahoumian fail to disclose assigning input and output flow for a node randomly. However, the final rejection states that Kamath teaches this feature at page 275, Thereom 3.6, and that it would have been obvious to combine the teachings of Datta,

Shahoumian and Kamath "because assigning the flow randomly to a node results in a more realistic model (Kamath: 'Abstract,' page 3)."

The Applicants disagree with this reasoning. Kamath is directed toward modeling of routing and admission control in a network. See, Abstract of Kamath and Section 2 of Kamath, "Model and Definitions." In Theorem 3.6, Kamath discusses use of a probability measure with respect to events that occur within the model. As discussed above, the Applicants' invention is directed toward generation of a fabric design problem specification. Such a fabric design specification is suitable as a starting point for finding a solution and is, therefore, useful for evaluating the effectiveness of design solution techniques. While both the Applicants' invention and Kamath broadly relate to networks, each are directed toward totally unrelated aspects of networks. Accordingly, there would not have been a motivation to combine Kamath with Datta or Shahoumain to achieve the Applicants' invention.

Moreover, as mentioned above, the design methods discussed by Shahoumian are various techniques for solving interconnect design problems, given a design problem as a starting point. See, slides 1-6 of Shahoumian. Datta is directed toward an apparatus for network capacity evaluation and planning in which simulated changes to an in-use network configuration may be made and evaluated. Datta at col. 2, lines 61-67. According, Datta and Shahoumian are unrelated to the object of Kamath with is directed toward modeling of routing and admission control in a network. In addition, the alleged motivation for making the combination (achieving a more accurate model) is entirely unrelated to the objects of Datta with Shahoumian. Rather, because they are unrelated, it would not have been obvious to combine Kamath with Datta or Shahoumain.

For at least these reasons, claims 27 and 29 are allowable.

Claims 26 and 28

Claims 26 and 28 stand or fall together with claims 1 and 13 from which they depend.

Conclusion:

In view of the above, the Applicants submit that all of the pending claims are allowable over the cited art. Accordingly, the Applicants request that the rejections be reversed.

Respectfully Submitted,

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(viii) Claims Appendix

1. A computer implemented method for generating an interconnect fabric design problem specification, the problem specification including requirements for a plurality of flows among a set of network nodes and the problem specification suitable for application of a design technique by which physical communication links and communication devices are arranged to meet the flow requirements, the method comprising selecting, from among the set of network nodes, a source node and a terminal node for a flow to be added to the requirements, determining a maximum capacity available at the selected source node and the selected terminal node, generating the flow having a capacity less than or equal to the lower of the maximum capacity of the source node and the terminal node and repeating said selecting, said determining and said generating thereby adding requirements for flows to the problem specification such that at least one of the source or terminal nodes is assigned more flows than there are ports available at the node.

2. The method according to claim 1, wherein said determining a maximum capacity comprises determining capacity available at each port of the source node and selecting the highest available capacity for the source node ports and determining capacity available at each port of the terminal node and selecting the highest available capacity for the terminal node ports.

3. The method according to claim 2, wherein said determining a capacity at a port of the source or terminal node depends on a specified degree of port saturation and unused port capacity.

4. The method according to claim 1, wherein said selecting, said determining and said generating is repeated until a stop condition is reached.

5. The method according to claim 4, wherein the stop condition is reached when each node in the set has at least a specified number of flows.

6. The method according to claim 1, wherein said set of network nodes comprises a cluster of nodes and wherein the design problem includes a plurality of clusters.

7. The method according to claim 6, wherein the design problem includes at least one flow between a pair of the clusters.

8. The method according to claim 7, wherein the design problem further comprises at least one node not in the clusters having a flow to a node in the clusters.

9. The method according to claim 1, further comprising generating an additional flow and determining whether to add the flow to the design problem according to a specified probability.

10. The method according to claim 9, further comprising repeating said steps of generating an additional flow and determining whether to add the flow to the design problem a number of times determined from a difference between a current number of flows and a specified maximum number of flows.

11. The method according to claim 1, wherein the flow is assigned to a single port at each of the source node and the terminal node.

12. The method according to claim 1, wherein the flow is split among multiple ports at one or both of the source node and the terminal node.

13. A system for generating an interconnect fabric design problem specification for communication among a set of nodes, the system comprising:

a set of design information including user-specified parameters for the design problem specification; and

a fabric design problem generation tool that generates the design problem specification for the interconnect fabric by adding flows to a set of flow requirements among the set of nodes in response to the design information such that at least one of the nodes is assigned more flows than there are ports available at the node and wherein said fabric design problem generation tool selects, from among the set of network nodes, a source node and a terminal node for a flow to be added to the flow requirements, determines a maximum capacity available at the selected source node and the selected terminal node, and generates the flow having a capacity less than or

equal to the lower of the maximum capacity of the source node and the terminal node.

15. The system according to claim 13, wherein said fabric design problem generation tool determines the maximum capacity at the source node by determining capacity available at each port of the source node and selecting the highest available capacity for the source node ports and wherein said fabric design tool determines the maximum capacity available at the terminal node by determining capacity available at each port of the terminal node and selecting the highest available capacity for the terminal node ports.

16. The system according to claim 15, wherein said fabric design problem generation tool determines a capacity at a port of the source or terminal node based on a specified degree of port saturation and unused port capacity.

17. The system according to claim 13, wherein said fabric design problem generation tool adds flows to the set of flow requirements until a stop condition is reached.

18. The system according to claim 17, wherein the stop condition is reached when each node in the set has at least a specified number of flows.

19. The system according to claim 17, wherein the stop condition is based on bandwidth levels of the flow requirements.

20. The system according to claim 13, wherein said set of network nodes comprises a cluster of nodes and wherein the design problem includes a plurality of clusters.

21. The system according to claim 20, wherein the design problem includes at least one flow between a pair of the clusters.

22. The system according to claim 21, wherein the design problem further comprises at least one node not in the clusters having a flow to a node in the clusters.

23. The system according to claim 13, wherein the fabric design problem generation tool generates an additional flow and determines whether to add the flow to the design problem according to a specified probability.

24. The system according to claim 23, wherein the fabric design problem generation tool repeatedly generates an additional flow and determines whether to add the flow to the design problem a number of times determined from a difference between a current number of flows and a specified maximum number of flows.

25. The method according to claim 1 wherein the capacity for a generated flow is randomly selected to be a value less than or equal to the lower of the maximum capacity of the source node and the terminal node.

26. The method according to claim 1 wherein the capacity available at a node is reduced by the capacity of each flow assigned to the node.

27. The system according to claim 13 wherein the capacity for a generated flow is randomly selected to be a value less than or equal to the lower of the maximum capacity of the source node and the terminal node.

28. The system according to claim 13 wherein the capacity available at a node is reduced by the capacity of each flow assigned to the node.

(ix) Evidence Appendix

None.

(x) Related Proceedings Appendix

None